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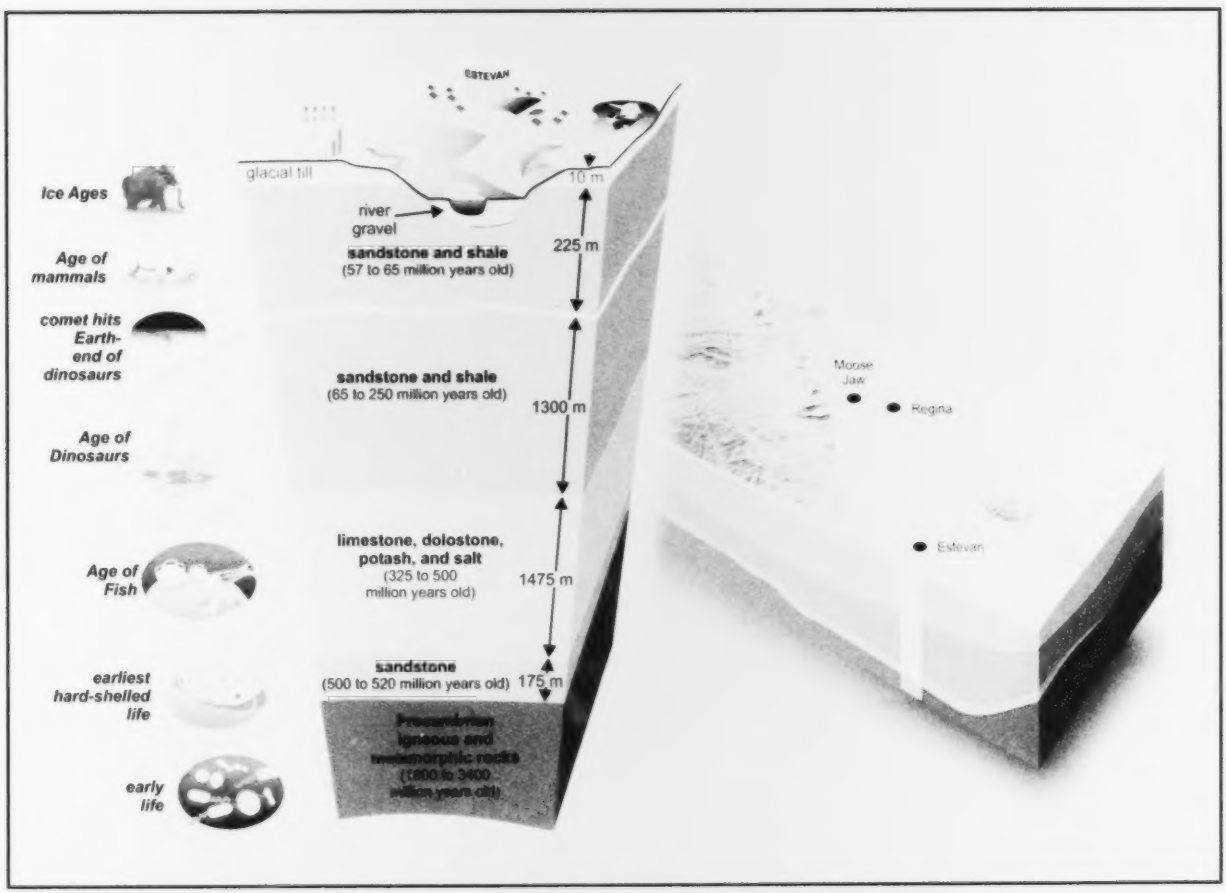
April 27 to 29, 2003

11th Williston Basin Horizontal Well and Petroleum Conference

Abstract Volume

Saskatchewan Geological Survey



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Cover:

What if we just kept digging?
An excerpt from the Geoscape Southern Saskatchewan poster to be published jointly with Natural Resources Canada (Geological Survey of Canada).
For more information about the poster, please see Geoscape Southern Saskatchewan by Haidl *et al.* (this volume).

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Preliminary Report on Conodont and Sm-Nd Isotope Data from Upper Ordovician Red River Carbonates (Herald and Yeoman Formations) in the Williston Basin, Berkley et al Midale 12-2-7-11W2, Southeastern Saskatchewan

F.M. Haidl, C. Holmden [1], G.S. Nowlan [2], and K.C. Fanton [1]

Haidl, F.M., Holmden, C., Nowlan, G.S., and Fanton, K.C. (2003): Preliminary report on conodont and Sm-Nd isotope data from Upper Ordovician Red River carbonates (Herald and Yeoman formations) in the Williston Basin, Berkley et al Midale 12-2-7-11W2, southeastern Saskatchewan; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-1.

Abstract

Recent research indicates that conodont and Nd isotope data are useful in interpreting the depositional history of Upper Ordovician epeiric sea carbonates in Saskatchewan and Iowa. Fluctuations in sea level changed the Nd isotopic balance in seawater by modifying the flux of Nd derived from weathering of the low relief Precambrian basement (εNd = -22 to -15) and from the highlands of the Taconic Orogen in the east and possibly from the extension of the Appalachian-Caledonian Orogen in the Arctic (εNd = -6 to -9). Thus, transgressions of epeiric seas over Precambrian rocks of the Transcontinental Arch and the Canadian Shield are recorded as increases in εNd to values greater than -15. Shifts of εNd values to lower values, particularly to those less than -9, probably reflect regression and re-exposure of Precambrian rocks. A water-depth relationship also appears to exist between conodont biofacies and Sm/Nd ratios: increasing Sm/Nd ratios correlate with deeper water biofacies whereas decreasing Sm/Nd ratios correlate with shallower water biofacies. The conodont biofacies of the Late Ordovician are, in order from shallowest to deepest water depths: 1) Rhipidognathus *biofacies, 2)* Oulodus-Aphelognathus *biofacies, 3)* Plectodina *biofacies, 4)* Phragmodus *biofacies, and 5)* Amorphognathus *biofacies.*

The relationships between sedimentology, conodont biofacies, εNd values, and Sm/Nd ratios have been demonstrated in preliminary studies conducted by the authors in Iowa and Saskatchewan. In order to further document their usefulness in the interpretation of depositional environments of oil-producing Red River strata (Herald and Yeoman formations) in Saskatchewan, detailed sampling of a core from the Berkley et al Midale 12-2-7-11W2 well was undertaken. This paper reports the results of 61 Sm-Nd isotope analyses and 62 conodont analyses obtained from this core which encompasses all but the upper 3.5 m of the Herald Formation as well as the upper 38.7 m of the Yeoman (Yeoman is 90.9 m thick). Preliminary observations include: 1) Specimens of Plectodina, *representative of the deepest water biofacies in this core, are present in 27 of 29 samples taken from an interval 4.8 m below the Yeoman top to the base of the core, and in five of seven samples from the middle portion of the Coronach Member of the Herald; 2) specimens of* Rhipidognathus, *representative of the shallowest water biofacies, are found only in samples from the upper 1.6 m of the core (Redvers Unit, Herald Formation); and 3) conodonts are sparse in the Lake Alma Member of the Herald Formation and all are assignable to* Panderodus bergstroemi *Sweet.*

[1] Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, SK S7N 5E2.
[2] Geological Survey of Canada, 3303 - 33rd Street NW, Calgary, AB T2L 2A7.

Red River Carbonates (Saskatchewan): Major Facies, Lithological, and Spatial Controls on Rock Magnetism – Preliminary Observations

Erika Szabo [1] *and Maria T. Cioppa* [2]

Szabo, E. and Cioppa, M.T. (2003): Red River carbonates (Saskatchewan): Major facies, lithological, and spatial controls on rock magnetism – preliminary observations; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-2.

Abstract

Preliminary results from ten wells in the Saskatchewan portion of the Williston Basin reveal significant lithological, facies, and spatial controls on the natural remanent magnetization (NRM) intensity in Red River carbonates. High NRM intensity values are recorded within the limestone sequences, intermediate values are seen in burrowed/fossiliferous dolostone, and the lowest values of NRM intensity are measured in laminated/bedded dolostones associated with anhydrite. The NRM intensity tends to increase towards the centre of the Williston Basin suggesting that the most probable variables affecting NRM intensities are: 1) depth of sampling and 2) proximity to the North American Central Plains Conductivity Anomaly. With a few exceptions, the magnetite grain-size distribution determined from partial anhysteretic remanent magnetization (pARM) spectra seems to be unaffected by facies and other lithological variations, or by spatial position. Well 0210, in the northwestern part of the Williston Basin, however, has magnetite grain-size values that are predominantly in the pseudosingle domain range whereas samples from the other wells display a mixed pseudosingle and single domain grain-size distribution. These findings suggest that fluid flow from the Alberta Basin may have influenced this portion of the Williston Basin.

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Ichnology of the Yeoman Formation, Southeastern Saskatchewan[1]

Rozalia Pak [2] and S. George Pemberton [2]

Pak, R. and Pemberton, S.G. (2003): Ichnology of the Yeoman Formation, southeastern Saskatchewan; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-3.

Abstract

The recognition and classification of trace fossils in the Upper Ordovician Yeoman Formation of southeastern Saskatchewan are made more difficult by the complex diagenetic history of these sediments. Since many primary characteristics of deposits greatly influence diagenesis, the distinction between sedimentary and diagenetic fabrics can be difficult. This problem presents itself clearly in an examination of the trace fossils of the Yeoman Formation that is characterized by conspicuous dolomite mottling. To date, it remains debatable whether these trace fossils represent Thalassinoides *or sediment dolomitization around smaller, causative burrows. Most ichnological studies have been done in clastics or chalks, and since such sediments are so different from Paleozoic platform carbonates, their methods are commonly difficult to apply. The purpose of this paper is to describe the trace fossils of the Yeoman Formation, and to explore their potential usage in determining changes throughout the deposition of this thick platform carbonate sequence.*

In the examination of the biogenic sedimentary structures of the Yeoman Formation, nine discrete trace fossils are observed. Many are part of composite burrow systems, and, except for Trypanites, Trichophycus, *and* Palaeophycus, *are indicative of feeding activities. The diversity of forms gives the impression of a diverse benthic fauna. The relatively uniform diameter of these feeding burrows suggests that a small group of organisms may have been responsible for the various forms. These burrowing organisms shifted their feeding behaviours in response to changes in paleoenvironmental conditions, such as water energy, depth, oxygenation, and nutrient availability. The association of more complex feeding structures with the vegetative-state, disseminated B* Gloeocapsomorpha prisca *alginite indicates that harsher conditions, which accompany the algal blooms, forced infauna to adapt their feeding behaviours.*

[1] This project is funded by Husky Oil Limited.
[2] University of Alberta, Department of Earth and Atmospheric Sciences, Earth Sciences Building, Edmonton AB T6G 2E3; E-mail: George.Pemberton@ualberta.ca

Saskatchewan's First Silurian Oil Producer: Nexen Bryant 7-4T-5-7W2

Barry W. Larson [1], W. Martindale [2], F.M. Haidl, and A. Nimegeers

Larson, B.W., Martindale, W., Haidl, F.M., and Nimegeers, A. (2003): Saskatchewan's first Silurian oil producer: Nexen Bryant 7-4T-5-7W2; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-4.

Abstract

Saskatchewan's first commercial Interlake oil reservoir was discovered in the Nexen Bryant 7-4-5-7W2M well, spudded on October 25, 2001, as an Ordovician Red River test. A drill-stem test of the Interlake, performed on penetration, flowed oil to surface. Upon completion of 7-4 as an Ordovician producer, the rig was moved 80 m to the west and 7-4T-5-7W2M was drilled and completed open-hole as an Interlake producer. To date, 7-4T has produced 17 600 m^3 of oil (March 2003). Initial average daily oil production of 218 m^3 (1371 bbl) was recorded in March 2002. By March 2003, production had declined to ~5.0 m^3 OPD at a 97 to 98 percent water cut. A third well at 11-4-5-7W2 was drilled in September 2002 to explore the limits of the Interlake structure. This well encountered the Interlake some 14 m lower than the 7-4 wells. Although the core from 11-4 has some fracturing and spotty oil stain, drill-stem tests of the Interlake recovered only drilling mud.

Oil produced from Nexen Bryant 7-4T-5-7W2 is light gravity (851 kg/m^3; 34.6 API), and is compositionally identical to oil extracted from cores in the Redvers area (Tp. 8, Rge. 32W1) and to Interlake oil from Nesson Anticline pools in North Dakota.

The Bryant Interlake reservoir is within the uppermost Taylorton sub-unit of the Interlake that is characterized by cyclical carbonates deposited under subaqueous hypersaline and arid/semi-arid subaerial conditions. The Taylorton sub-unit may be subdivided into four zones, in ascending order A through D. Zone A, the basal unit of a typical cycle, is composed of grey to cream, finely crystalline to microcrystalline, dolomudstone which is in places silty and/or sandy. Faint root traces are observed in some cores. Zone B, consists of dark red to purple, microcrystalline to extremely finely crystalline, occasionally silty, dolomudstones overlain by salmon pink to reddish grey microcrystalline dolomudstone with channels and seams interpreted as root traces. The lower part of Zone C is similar to the upper portion of Zone B but lacks the reddish/pink colouration. The upper part of Zone C consists of dolomudstones with rootlets and poorly defined fenestrae, or dolopackstones and dolograinstones with well defined fenestrae and peloids. Zone D is interpreted as a caliche or calcrete paleosol, characterized in ascending order by: i) peloidal or glaebular dolopackstones; ii) angular breccias or mud-supported intraclast dolorudstones; iii) poorly sorted peloidal dolopackstones and dolograinstones; and iv) medium to dark brown microcrystalline to cryptocrystalline dolomudstones containing clasts of grey or tan peloidal, in places fenestral, grainstones. Cement-lined and mud-filled sheet cracks are common in iii) and iv). The cements are commonly banded and hang from the roofs of cracks.

Porosity is best developed in the grainstones in the upper part of a typical cycle. Vuggy and leached moldic porosity types are the most common. Most primary interparticle, fenestral, and fracture/channel porosity is occluded by multiple generations of carbonate cements and late-phase anhydrite. Reservoir tests and initial production rates suggest the reservoir is highly fractured and that most of the high productivity is related to this fracturing.

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[2] W. Martindale Consulting Ltd., Box 6 Site 20 RR #9, Calgary, AB T2J 5G5; E-mail: b4martin@telus.net.

Devonian Isopach and Structure Maps, IEA Weyburn CO_2 Monitoring and Storage Project Area

L.K. Kreis, P.L. Thomas, R.B. Burke [1], and S.G. Whittaker

Kreis, L.K., Thomas, P.L., Burke, R.B., and Whittaker, S.G. (2003): Devonian isopach and structure maps, IEA Weyburn CO_2 Monitoring and Storage Project area; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-5.

Abstract

The International Energy Agency Weyburn CO_2 Monitoring and Storage Project is a multi-disciplinary, multi-agency investigation into the storage of anthropogenic CO_2 in Mississippian carbonates of the Midale Beds in southeastern Saskatchewan. Part of the Geoscience Framework component of the IEA project involves mapping the Phanerozoic succession over a 200 km x 200 km area centred around the Weyburn Pool and extending approximately 60 km into the United States. The results will be integrated with other geoscience data to develop a 3-D model of the geosphere enveloping the CO_2 target rocks of EnCana's Weyburn Pool Midale reservoir. Mapping of Devonian carbonates and evaporites represent an important portion of this work as isopach maps of Devonian salt units indicate areas of salt dissolution that may be susceptible to cross-formational fluid migration. These locations are of particular interest to the Weyburn CO_2 Storage and Monitoring Project. The mapping of Devonian salt units and identification of areas of dissolution may also be important to our understanding of both hydrocarbon migration fairways and the distribution of reservoir rocks and traps.

Subsurface mapping spear-headed by Saskatchewan Industry and Resources in the IEA Weyburn CO_2 Monitoring and Storage Project area (Weyburn Project Area) is an integral part of a systematic subsurface mapping strategy for southern Saskatchewan. This strategy envisions the eventual mapping of all major Phanerozoic units throughout the province, with delivery of products in time-frames and formats of maximum value to the petroleum and mineral resource industries. Devonian mapping results from the Weyburn Project area have recently been published on a test version of a CD-ROM entitled, "Devonian Isopach and Structure Maps, IEA Weyburn CO_2 Monitoring and Storage Project Area". This product includes computer-generated (Surfer 8) regional isopach maps of the ten formally recognized formations, six halite (salt) subunits and four groups comprising the Devonian System in Saskatchewan, along with structure maps of the ten formations. In addition to the maps, geological tops, a description of the Saskatchewan Land Survey System, and a questionnaire is included. Copies of this CD are available upon request [2]. Comments and suggestions from this questionnaire will be used to help prioritize and format our subsurface mapping products in future.

[1] North Dakota Geological Survey, 600 East Boulevard Avenue, Bismarck, North Dakota, USA, 58505-0840.
[2] Available from K. Kreis, Petroleum Geology Branch, Saskatchewan Industry and Resources, 201 Dewdney Avenue East, Regina, SK S4N 4G3.

A Preliminary Report of Upper Devonian Conodonts from the Birdbear and Duperow Formations of Southeastern Saskatchewan[1]

A.D. McCracken [2] and L.K. Kreis

McCracken, A.D. and Kreis, L.K. (2003): A preliminary report of Upper Devonian conodonts from the Birdbear and Duperow formations of southeastern Saskatchewan; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-6.

Abstract

Conodont biostratigraphy has only been attempted in a small number of samples and from few Devonian units in Saskatchewan. This paper reports results from 39 samples from 10 wells penetrating the Duperow and Birdbear formations in southeastern Saskatchewan. Conodonts were recovered from most samples, but the middle and upper units of the Birdbear Formation and Lower Wymark Member of the Duperow Formation were mainly barren. Most conodont identifications are tentative and more study is required

[1] Geological Survey of Canada Contribution No. 2002258.
[2] Geological Survey of Canada, 3303 - 33rd Street NW, Calgary, AB T2L 2A7.

IEA Weyburn CO_2 Monitoring and Storage Project: Geoscience Framework Update[1]

Steve Whittaker and Chris Gilboy

Whittaker, S. and Gilboy, C. (2003): IEA Weyburn CO_2 Monitoring and Storage Project: Geoscience framework update; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-7.

Abstract

Geological storage of CO_2 is considered to be among the most promising methods of effectively reducing greenhouse gas emissions to atmosphere. The International Energy Agency Weyburn CO_2 Monitoring and Storage Project is a research effort studying geological storage of CO_2 within Mississippian carbonates in the Weyburn Pool, southeastern Saskatchewan. The Geoscience Framework portion of this project is providing data on the integrity of the geological container. These data will be used for risk analysis and to model the long-term fate of CO_2 in the subsurface.

All major stratigraphic units throughout the geologic column, and many subordinate evaporite layers, are being mapped within a 200 km x 200 km region of southeastern Saskatchewan and parts of Montana and North Dakota. Approximately 1600 km of 2-D seismic data in this area will be integrated with the stratigraphic information which will help to define basement structures that may have influenced depositional features. Hydrogeological data are undergoing rigorous examination to update basin hydrostratigraphy to better define the distribution of flow units, and the directions and rates of subsurface and near-surface fluid movements. Detailed geological investigations of selected geological units will enhance our understanding of aquitards (seals) and aquifers. The occurrence and distribution of surface lineaments have been mapped in detail to examine whether a relationship exists between their location and deeper geological features that may influence subsurface fluid movement. Soil gas studies are being performed to monitor soil gas compositions and to determine whether soil gas contents change across surface lineaments. The above data are being integrated into a common earth model to describe the geosphere within the Weyburn Project area.

[1] Support has been provided by the PTRC of Regina through the generosity of many sponsors, including SIR, to the IEA Weyburn Project.

Some Thoughts on the Formation of Calcium Sulphate Deposits in Paleozoic Rocks of Southern Saskatchewan

D.M. Kent [1]

Kent, D.M. (2003): Some thoughts on the formation of calcium sulphate deposits in Paleozoic rocks of southern Saskatchewan; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-8.

Abstract

Calcium sulphate rocks, common in the subsurface of southern Saskatchewan, are most abundant in Paleozoic strata of Ordovician to Mississippian age. Because of their evaporitic origin, they are important to the interpretation of the depositional settings of large parts of the Paleozoic rock record. Additionally, they act as effective top and seat seals to several hydrocarbon reservoirs within the Williston Basin. Given their economic and scientific importance, it is noteworthy that the origins of these evaporites have at times been misinterpreted. A review of the textures of the significant calcium sulphate evaporites in Ordovician, Upper Devonian, and Upper Mississippian rocks in southern Saskatchewan suggests that deposition of the majority of the evaporite units was initiated by the pelagic settling of gypsum crystals in water depths greater than 10 m. Some deposits, particularly those in the Mississippian Midale, Ratcliffe, and Poplar Beds, terminated in a desiccation phase that led to the formation of shallow pond or sabkha facies evaporites. There is no indication of a sabkha facies in the Ordovician Lake Alma Evaporite (Herald Formation) or in those evaporites of the Wymark Member of the Upper Devonian Duperow Formation. In summary, subaqueously deposited evaporites are common in Paleozoic rocks of Saskatchewan, whereas sabkha facies evaporites are rare.

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Refining Compositional Affinity of Williston Basin Family C Oils Using Multivariate Statistical Analysis of Saturate Biomarkers

M. Obermajer [1], K.G. Osadetz [1], and N. Pasadakis [2]

Obermajer, M., Osadetz, K.G., and Pasadakis, N. (2003): Refining compositional affinity of Williston Basin family C oils using multivariate statistical analysis of saturate biomarkers; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-9.

Abstract

This study presents preliminary results of a Principal Component Analysis (PCA) performed on mass spectrometry data obtained from analyses of family C oils produced in the Canadian sector of the Williston Basin. Molecular methods based on saturated hydrocarbon biomarkers are commonly considered the most powerful oil-oil correlation tool, but these techniques often rely on a limited number of molecular characteristics that may obscure the significance of a biomarker signature. Here, PCA is used to maximize diagnostic information carried in a broader terpane and sterane spectrum. The family C oils are distinguished from other oil families occurring in this basin primarily based on differences in the compositions of their medium and higher molecular weight (C_{12}-C_{40}) saturate fractions. Although a number of commonly used biomarker characteristics indicate a high compositional affinity within the family, there is a minor but persistent tendency for the oils to separate into two groups corresponding to the two main geographical areas of their occurrence. This separation pattern is more evident when PCA is applied to biomarker data. Both biomarker compositional and ratio models show a more significant division between oils from the southeast (Cse) and the southwest (Csw) compared with the standard biomarker cross-plots. Factor loadings indicate that the variance in terpane compositional model PC1 is controlled by the relative abundance of tricyclic and pentacyclic terpanes. There is a greater internal variability of the PC1 within the Cse oils, suggesting a greater compositional diversity of their source kerogen and a mixed contribution from algal and microbial precursors. In contrast, the Csw oils are probably derived from a more homogeneous source. Variations in PC2 are controlled by the relative amounts of trisnorhopanes, C_{29} and C_{30} hopanes, and C_{24} tetracyclic terpanes. Such compositional differences are commonly attributed to unique source rock paleodepositional environments. The subdivision of the C oils into two groups determined from a terpane compositional model is substantiated further by PCA models using sterane compositional data and a combination of biomarker ratios. While this subgrouping is delineated mainly by the sterane ratios, variability in terpane ratios defines internal diversity within the Cse oils. There is a general tendency for the Cse oils to show a greater internal variation compared with a relatively smaller variation within the Csw oils. This suggests much greater source heterogeneity for the Cse oils implying mixing of multiple-sourced oils or a progressive change in organic facies. The biomarker contrast between the two groups of oils likely reflects differences in the primary composition of the source organic matter, slightly amplified by the regional differences in oil thermal maturity. Overall, PCA of biomarker compositional signatures, interpreted separately or in combination, enhances the oil-oil correlation and interpretation of petroleum systems, especially when combined with geochemical information from the other petroleum fractions and local geology.

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Organic Facies Analysis of the Cretaceous Lower and Basal Upper Colorado Group (Cretaceous), Western Canada Sedimentary Basin – A Preliminary Report

L. Buckley [1] and R.V. Tyson [1]

Buckley, L. and Tyson, R.V. (2003): Organic facies analysis of the Cretaceous lower and basal Upper Colorado Group (Cretaceous), Western Canada Sedimentary Basin – a preliminary report; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-10.

Abstract

The Cretaceous Colorado Group (Albian-Santonian) is a sequence of dominantly homogeneous organic-rich shales derived from sediments deposited within the Western Interior Seaway of North America. Bulk geochemical analysis (Rock-Eval, TOC, Total Carbon, Total Sulphur), and palynofacies observations have been conducted on 452 core samples in order to reconstruct the organic facies variations through the lower part of the Group and along transects across the Canadian portion of the Western Interior Seaway.

The Viking and Westgate formations are typified by low percentages of poorly preserved (weakly fluorescent) marine amorphous organic matter (AOM) and abundant terrestrial phytoclasts, associated with low TOC and average measured hydrogen indices of only 106 mgHC/gTOC (Type III kerogen). The Fish Scales and Belle Fourche formations have a transitional organic facies reflecting mixing with better preserved marine AOM, and thus exhibit higher mean TOC and measured HI values (158 and 170 respectively). The Second White Specks Formation and the basal Upper Colorado Group are both dominated by moderate to strongly fluorescent AOM, resulting in a mean measured HI of 320 (Type II kerogen). The mean average HI values of the Type III and Type II kerogen components, computed from the slope of S2 versus TOC trends, are approximately 170 and 500 respectively. The transgressive Albian-Turonian interval is associated with a progressive upward decrease in terrestrial phytoclast supply, and progressive improvement in the preservation of the AOM, related to changing basin redox conditions.

Stable carbon isotope analysis has identified a significant (~4 ‰) positive shift in $\delta^{13}C_{org}$ values in the vicinity of the Belle Fourche–Second White Specks Formation boundary in three Western Canada Sedimentary Basin cores. This is interpreted as the regional expression of the isochronous Cenomanian-Turonian (C-T) global isotopic event. The formation boundary apparently becomes older towards the east, where the lower siliciclastic input allows the development of a calcareous facies to occur earlier than in the west.

[1] NRG, School of Civil Engineering and Geosciences, University of Newcastle upon Tyne, England, NE1 7RU; E-mail: Lisa.Buckley@ncl.ac.uk, or R.V.Tyson@ncl.ac.uk.

Stratigraphic Relationship of Alderson (Milk River) Strata Between the Hatton and Abbey-Lacadena Pools, Southwest Saskatchewan – Preliminary Observations

Per Kent Pedersen

Pedersen, P.K. (2003): Stratigraphic relationship of Alderson (Milk River) strata between the Hatton and Abbey-Lacadena pools, southwest Saskatchewan – preliminary observations; *in* Summary of Investigations 2003, Volume 1, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2003-4.1, CD-ROM, Paper A-11.

Abstract

Large quantities of economically recoverable gas have recently been discovered within the Alderson Member of the Lea Park Formation in the Abbey-Lacadena pools. This occurrence, located approximately 50 km northeastward of the Hatton Pool, has sparked exploitation within the area as well as exploration for similar plays in southwestern Saskatchewan. Strata of the Alderson Member are commonly identified by industry and government as belonging to the Milk River Formation. Recent research has demonstrated, however, that Alderson strata are younger than those of the Milk River Formation. Within the Abbey-Lacadena pools, the Alderson Member is composed of stacked, subtly upward-coarsening, parasequences. Gas is hosted in thin, very fine grained sandstone beds interbedded with silty mudstones. The sands likely were deposited in a storm-dominated, pro-delta setting below fair-weather wave base. The main productive sandstone is a lowstand unit, which both onlaps and is overlain by mudstones. Structural maps of the Alderson Member (Milk River shoulder) indicate a structural influence on gas accumulation in the Abbey-Lacadena pools, and possibly also on the northern, eastern, and southeastern pool boundaries of the Hatton Pool. Thus, initial results indicate that the trapping mechanism of gas within the Abbey-Lacadena pools is likely a combination of stratigraphy and structure. Further research will evaluate the influence of other gas-trapping mechanisms such as gas trapped below updip water, or gas trapped within downdip fine-grained facies as a result of high capillary pressure.

The Late Cretaceous (Campanian) Sub-Lea Park Unconformity, Southeastern Saskatchewan[1]

J.E. Christopher[2] *and M. Yurkowski*

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Abstract

Mapping of Cretaceous formations in the Saskatchewan portion of the area under study by the Geoscience Framework component of the International Energy Agency Weyburn CO_2 Monitoring and Storage Project reveals the presence of a pronounced erosional unconformity between the Santonian Milk River (Alderson) and the Campanian Lea Park formations. Erosional relief is about 260 m between southwestern Saskatchewan and the southeast, but is accentuated by an erosional escarpment 200 m high, aligned along the downward projection of the present day topographic Missouri Escarpment east of the City of Weyburn. Like its present day counterpart, the sub-Lea Park escarpment forms the eastern edge of a western upland region, and overlooks a country of low-relief (60 m) knolls and depressions to the east. Lea Park sediments fill in the underlying terrain with 25 m thick, basal fluvial sands in thalwegs, which are partially reworked and buried under 30 m thick, deeper water bituminous shales. Later sediments and their Belly River equivalent tongues bury the sub-Lea Park terrain by onlap and progradational downlap.

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Geoscape Southern Saskatchewan

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Abstract

Geoscape Southern Saskatchewan is an outreach project sponsored by Natural Resources Canada (Geological Survey of Canada) and Saskatchewan Industry and Resources in collaboration with partners from industry, universities, K-12 schools, and other government and geoscience organizations. The prime purpose of Geoscape Southern Saskatchewan is to explain in a simple and direct way how our geological heritage and the geological processes most active in the southern half of the province affect the lives of the area's residents. A large format poster has been developed and is in the final editing stage. It will be printed in the summer of 2003 and the poster contents added to the national Geoscape Website (www.geoscape.nrcan.gc.ca).

The central graphic of the Geoscape Southern Saskatchewan poster features a satellite image draped over a digital elevation model atop a 3-D model of the subsurface geology of the province. A special place has been reserved for "Scotty", Saskatchewan's own Tyrannosaurus rex. *Thematic panels surrounding the central image focus on the links between glaciation, topography, land use, water resources, and geologic hazards in the area south of the Precambrian Shield edge. The value of the Saskatchewan River system and groundwater resources is emphasized. Southern Saskatchewan's energy and mineral resources, including coal, petroleum, potash, and diamonds, are also highlighted and are placed in their geological and economic contexts.*

Text for the poster has been written at a Grade 8 comprehension level to meet the needs of a broad range of users. Our main target audience is K-12 students and their teachers. The usefulness of the poster to this group will be greatly enhanced by a spin-off project, led by the Saskatchewan Geological Society. Additional geoscience, engineering, economic, and community information plus classroom activities will be developed for publication in CD and paper format, and for inclusion on a planned Geoscape Southern Saskatchewan Website.

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